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POSTURE DURING ANESTHESIA—ITS EFFECT*

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A PATIENT undergoing an operation entrusts his life and safety to the surgeon and anesthetist. The obligation of these physicians is to protect this life as tenderly and wisely as the obstetrician cares for a new-born infant. An artist's touch and interest are needed to fulfill this trust. The conduct of the operation is made easier by having the posture as nearly correct as possible.

As the teaching of good posture in clinics and in schools is a part of preventive medicine,[1] so the assurance of good posture during anesthesia is an important means of preventing undesirable complications or dangerous sequellae. The additional relaxation secured from careful, correct posture facilitates the entire operative procedure.

THE IDEAL OPERATING TABLE

An ideal operating table is one which is constantly and in every position under perfect control. It is best to have the table top locked in any position obtainable by its mechanism, making accidents through carelessness practically impossible. The anesthetist should be familiar with all the possibilities and limitations of the adjustments. Adequate brakes are essential. Doctor Harvey,[2] in his chapter on complications in surgery, states that many of the discomforts following operations are the result of prolonged immobilization upon the operating table during anesthesia. "With a poorly padded table, the points of contact will be sore for some time afterward, and if the extremities happen to hang over the edge or are too tightly bound down by the retention strapping, stiff and tender joints and muscles are the result." It is very important that a thick, firm mattress [2, 12] be used. Having the conscious patient resting comfortably on the table is an aid to smooth induction of anesthesia. Cloth ties, one lengthwise and the other crosswise, may be used to hold the mattress in place. When these are tied securely the patient does not shift position, rendering shoulder crutches unnecessary. A guard with a curved base slips under the mattress which holds it in place. Having the guard freely movable makes it possible to obtain the correct relationship to the patient instead of placing the patient to suit the guard of limited positions.

A canvas lifter, about one yard long, may be placed on top of the mattress where it will support the heaviest part of the patient in moving him to different positions while on the table and in lifting him from the table to the ambulance. A longer lifter with poles in hems at the sides placed on the ambulance with the covering blanket over it facilitates the moving of patients and distributes the weight evenly. A death is reported to have occurred from the accidental sudden dropping back of the head of an unconscious patient, proving the need of adequate support.

OPERATIVE POSITIONS

In 1924 Doctor Palmer [3] presented to the Anesthetic Section modifications of some of the operative positions. A consideration of these and other positions in common use with changes which increase relaxation and add to the patient's comfort follows.

Dorsal Position.—The usual dorsal position with the patient flat on his back causes much strain. The pelvis is extended and the lumbar spine is elevated, causing the abdominal wall to be stretched. Thus the capacity of the abdomen is lessened and the abdominal pressure is increased. Respiration is interfered with; the diaphragm and heart, having extra work, become fatigued more readily. The abdominal muscles are used to supplement respiration by producing forced expiration.[4] It is the desire of every surgeon to manipulate the intestines as little as possible, but this cannot be accomplished if the intra-abdominal pressure is too great. The knees are in a position of hyperextension, which may result in postoperative pain (Fig. 1).

There are modifications which aid in relieving this strain. One or two pillows of proper size, according to the depth of the chest, should be placed to support the head and relax the neck. Too much flexion of the head [5] throws the base of the tongue against the pharynx and may produce stertor and obstruct breathing. Extreme extension limits the natural protective action of the epiglottis. It makes swallowing difficult or impossible and increases the possible danger of entry of mucus and foreign substances into the larynx (Fig. 2).

Tension on the abdomen can be lessened by flexing the pelvis, using a bolster under the knees and, further, by raising the thigh and leg portions of the table. An awkward angle in which to operate results if the thighs are raised beyond a practical limit, which varies, of course, with the con-

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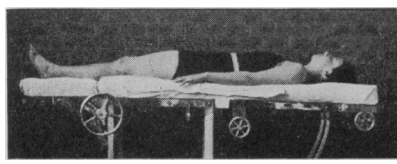

Fig. 1.—Usual dorsal position.

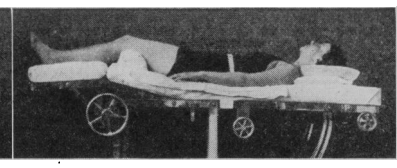

Fig. 2.—Modified dorsal position.

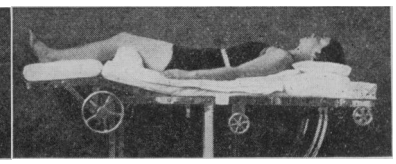

Fig. 3.—Modified dorsal position with chest pillow.

tour of the patient and the nature of the operation. In some instances, still more relaxation may be obtained by elevating the thorax with another firm pillow (Fig. 3).

The advantages of this correct dorsal position are readily seen. The anterior abdominal wall is relaxed, the abdominal muscles are not needed for forced expiration, respiration is quieter, and less fatigue results. Manipulation of the intestines is minimized, lighter anesthesia is made possible, and shorter operating time is required.

The anesthetic guard, suitable head pillow, thick mattress, cloth tie, small canvas lifter, and bolster are shown in Fig. 4.

Trendelenburg Position.—The customary Trendelenburg position (Fig. 5) increases the tension of the abdominal muscles, and all of the disturbances brought about by similar strain in the ordinary dorsal position are intensified. There is a greater tendency to prolapse of the intestines, and it is a serious disadvantage to the patient because more trauma than necessary may result. When the intestines fall toward the epigastrium and, in addition, are packed off with gauze, the function of the diaphragm may be hindered. This interference with adequate respiration may lead to cardiac failure. In his paper on "Flexion of the Pelvis in the Trendelenburg Position," Doctor Rixford [4] brought out the fact that some surgeons attempted "to overcome the disadvantages of the conventional Trendelenburg position by keeping the legs extended when the table is tilted, holding the patient from sliding by means of shoulder rests. This corrects only a small part of the trouble and has the positive disadvantage of increasing the height of the arterial blood column above the heart, giving that organ more work to do." He states: "It would seem that what the lumbar spine wants in order not to be set aching after prolonged operation is not more support, as some have averred, but more relaxation, such as is given by flexion of the pelvis."

Modified Trendelenburg Position.—As in the dorsal position, having a bolster placed under the knees and having the pelvis flexed by elevating the thighs and supporting the legs relieves the abdominal tension in the Trendelenburg position. From twenty to thirty degrees of elevation is usually sufficient. It is a common error to lower the legs as far as possible after the thighs are raised. When this is done, the abdominal muscles are again made tense.

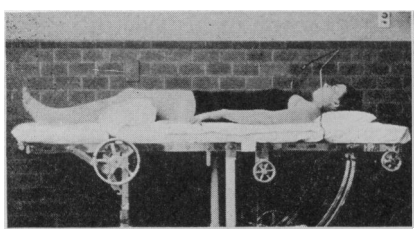

Fig. 4.—Guard, head pillow, thick mattress, cross-tie, small canvas lifter, and bolster.

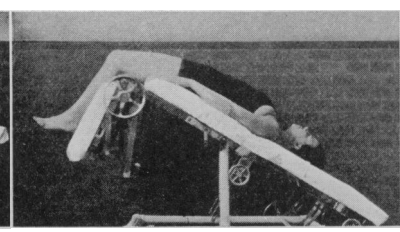

Fig. 5.—Customary Trendelenburg position.

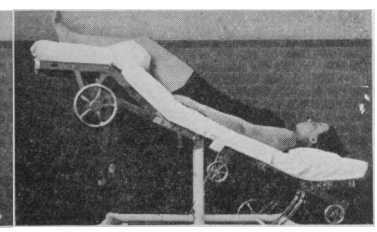

Fig. 6.—Modified Trendelenburg position.

Abdominal relaxation is not aided by the use of a back pillow though in some instances it may decrease postoperative backache (Figs. 6 and 7).

Any change of posture while the patient is under an anesthetic should not be made suddenly. this is particularly true when the Trendelenburg position is used. There is less alteration in the blood pressure when the patient is moved to the Trendelenburg position from the modified dorsal position than when the change is made directly. Shock [5] is seldom seen in patients who are operated on in this position since the blood pressure rises sufficiently to counteract any fall caused by the incidental trauma. Doctor Gatch [6] concluded

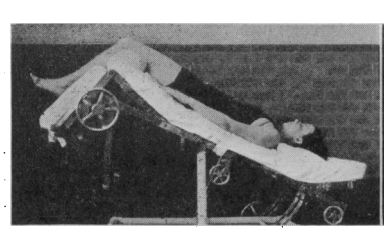

Fig. 7.—Modified Trendelenburg position with extreme lowering of legs.

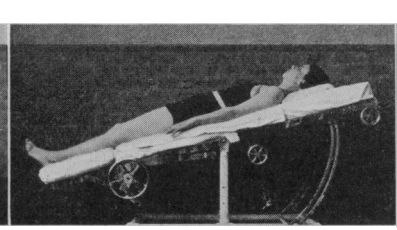

Fig. 8.—Usual reverse Trendelenburg position.

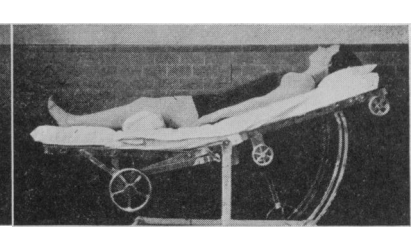

Fig. 9.—Modified reverse Trendelenburg position.

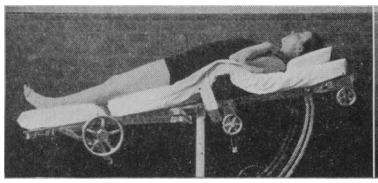

Fig. 10.—Usual position for gall-bladder operation.

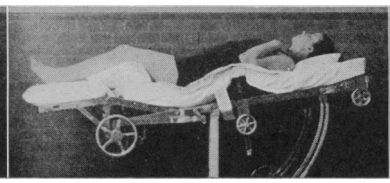

Fig. 11.—Modified position for gall-bladder operation.

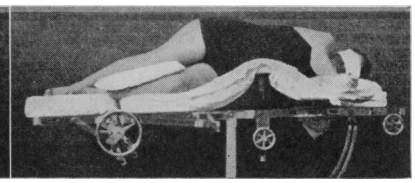

Fig. 12.—Lateral recumbent position for kidney operations.

from animal experiments on circulatory disturbances due to laparotomy, posture, and anesthesia that life is possible when the intra-abdominal pressure has been reduced to that of the atmosphere, only when the return of blood to the heart is assisted by gravity and when the animal is not required to make any exertion.

The Trendelenburg position should not be used in the presence of cyanosis or struggling and should be used with caution in a patient whose heart is diseased. This position is of great value to the anesthetist in securing postural drainage [7] in patients with considerable mucus and may be desirable in some patients after operation, especially when a degree of shock is present. The return to the horizontal position [5, 8] may lead to collapse if made suddenly.

The modified Trendelenburg position gives the pelvic exposure desired without unduly crowding the abdominal contents and abdominal pads against the diaphragm, neither embarrassing the heart nor interfering with quiet respiration. This can be accomplished without such extreme lowering of the head of the table. DaCosta [8] states that flexion of the legs often causes much stiffness and may predispose to embolism. These complications are practically eliminated by the suggested modification of the Trendelenburg position. The possibility of having this greater relaxation by using this posture frequently allows the choice of anesthetic to be the less toxic nitrous oxid instead of the more toxic ether.

The reverse Trendelenburg, the lateral recumbent, the prone and the extreme lithotomy positions present characteristic difficulties which may be overcome to some extent by certain modifications.

Reverse Trendelenburg Position.—In the reverse Trendelenburg or Fowler position, there is increased danger of aspiration unless suction facilities are at hand, since drainage by turning the head is ineffective. Doctor Miller,[9] in his tabulation of one thousand cases to determine the effect of posture on the blood pressure during operation under anesthesia found that in the reverse Trendelenburg position there was a marked tendency to decline in the systolic pressure. Doctor Gatch,[6] experimenting on animals on the peripheral theory of shock, found that "a dog when etherized till its muscles are completely relaxed will die in the head-up posture, while it will be little affected by the same if unetherized or etherized lightly." He reports that Doctor Mann,[10] in his investigation of shock concluded that experimental surgical shock is caused almost entirely by accumulation of blood in the abdominal viscera; that such an accumulation may be brought about by deep anesthesia alone, especially when associated with the head-up posture. Doctor DeCourcy,[11] in his paper on "Venous Stasis as a cause of Postoperative Embolism," states that Lockhart-Mummery [12] believes that pulmonary embolism is frequent after gynecologic and gall-bladder operations largely because of the unnatural position in which the patient is placed upon the table. His own observations show that the Fowler position is especially conducive to the later development of embolism. He finds that elevation of the pelvis and lower extremities after operations below the diaphragm prevents venous stasis and in this way reduces the danger of postoperative thrombosis and embolism. Doctor Harvey,[2] in writing of the circulatory complications in surgery, says that the treatment of thrombophlebitis, undoubtedly induced indirectly as a result of operative procedures and of embolism, is prophylactic, suggesting frequent shifting of the position of the legs following, and the avoidance of a dependent position, during operation.

It is possible to better the entire anesthetic condition and increase the relaxation in the reverse Trendelenburg position by flexing the thighs, raising the legs and giving added support with a bolster under the knees. The strain on respiration is greatly diminished (Figs. 8 and 9).

Gall-Bladder Operations.—Certainly the position for gall-bladder operations is unnatural and is likely to result in postoperative backache. The modifications suggested effect a position of less strain. It is always important that the body elevator be not raised beyond a reasonable height and lowered as soon as possible. With this aid to relaxation of better posture, deep anesthesia, which promotes venus stasis, can be avoided and an an-

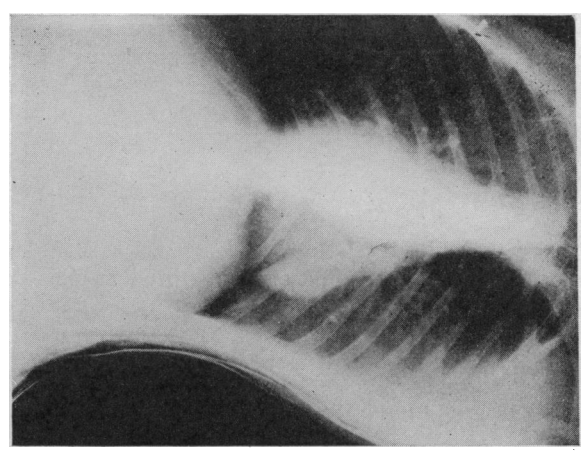

Fig. 13.—Roentgenogram showing crowding of vital organs in kidney operations position.

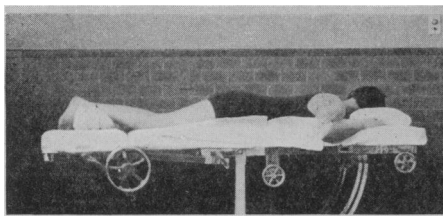

Fig. 14.—Prone position.

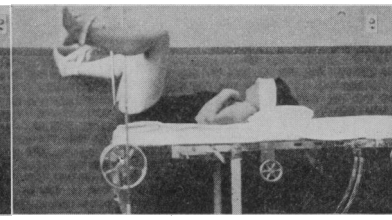

Fig. 15.—Usual lithotomy position.

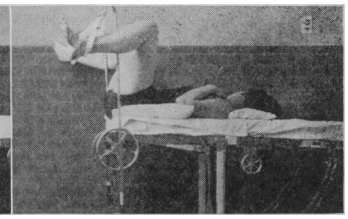

Fig. 16.—Lithotomy position modified by hip pillows.

esthetic so light as to preserve muscular tone is possible, lessening the liability of shock (Figs. 10 and 11).

Kidney Operation.—The position used in kidney operations presents added difficulties when the incision is on the right side. The patient lies on his left side, the arm supported on a board slipped under the mattress and extending the proper distance. A pillow relieves the pressure of the upper leg and serves to aid in maintaining the position. When the body elevator is raised, the heart is crowded and, because of the limitation of movement of the ribs, there is extra work for the diaphragm in breathing. The left lung is decidedly hindered in its movements, and this circulatory and respiratory embarrassment may readily lead to shock. The effect upon the circulatory system [5] of the operation may act to increase the circulatory depression, secondary to the result of posture. To overcome this the body elevator should be raised only to the point of giving adequate exposure and lowered the first minute possible (Figs. 12 and 13).

Operations on Spine.—In operations on the spine, when the patient is in the prone position, less shock follows if there is adequate breathing space. The adult patient is anesthetized on his face in a comfortable attitude, having firm hair pillows under each shoulder and each anterior prominence of the pelvis. In orthopedic surgery on children [13] it is best to induce anesthesia in a comfortable dorsal position, changing to the operative position desired after full anesthesia is obtained. In some instances a pillow under the shoulder and another under the hip on the same side, will lift the body sufficiently to make breathing easy and also give a satisfactory position. This advantage of unimpaired respiration is very real since the greatest danger in ankylosing operations of the spine is considered [14] by some to be the anesthesia. Circulatory depression would soon follow inadequate respiratory movements if prolonged unduly. Having the mouth open when any jarring of the spine occurs during the operative procedure distributes the impact. The harmful effects of the required posture are minimized by attention to these details (Fig. 14).

Lithotomy Position.—When an operation is to be performed with the patient in the lithotomy position, it is advisable that induction of the anesthetic be made in the dorsal position and full anesthesia secured before the legs are placed in the supports. A fatality,[15] due to "cardiac dilatation," has been reported when the patient was in the lithotomy position during induction. In this position the heart is considerably embarrassed by pressure of the abdominal viscera upon the diaphragm which may also interfere with respiration. The systolic blood pressure tends to increase.[9] When the operation is necessarily prolonged as in vaginal plastic work, the strain of this position is great. With the relaxation of the muscles from anesthesia,[2] unusual strain is placed upon the joint capsules and the cartilaginous structures and leads to varying degrees of postoperative discomfort.

Firm hair pillows placed at the side and a little under the hips give the thighs and legs a beneficial support, relieving the abnormal weight placed on the joints. Less postoperative pain has been reported since the use of these pillows (Figs. 15 and 16). In an effort to secure the proper operative position the patient is often brought down too far over the edge of the table. This causes considerable backache following the operation and temporary or permanent sacro-iliac damage may be severe, leading in one known instance to legal suit against a hospital (Fig. 17).

Operations on Prostate.—The position for operations on the prostate, being an extreme lithotomy position, sometimes combined with a degree of Trendelenburg, crowds the heart and lungs still more, as is shown in the roentgen ray. The shoulder braces must necessarily be well padded and securely held to prevent bruising and slipping. A slow, gentle return to the horizontal position is essential to avoid undue lowering of the patient's resistance, especially since most of these patients are aged (Figs. 18 and 19).

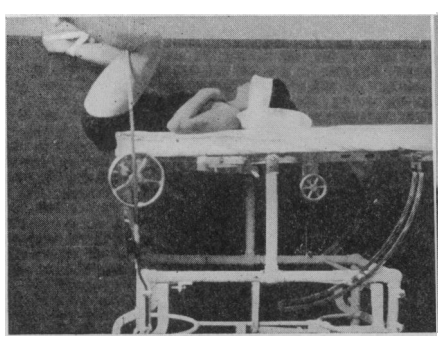

Fig. 17.—Lithotomy position, with body too far over end of table.

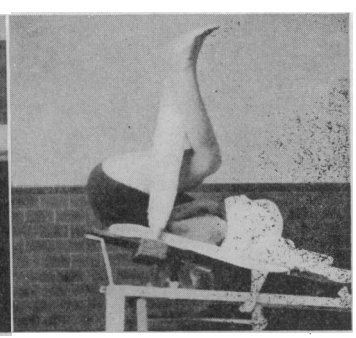

Fig. 18.—Perineal prostatectomy position.

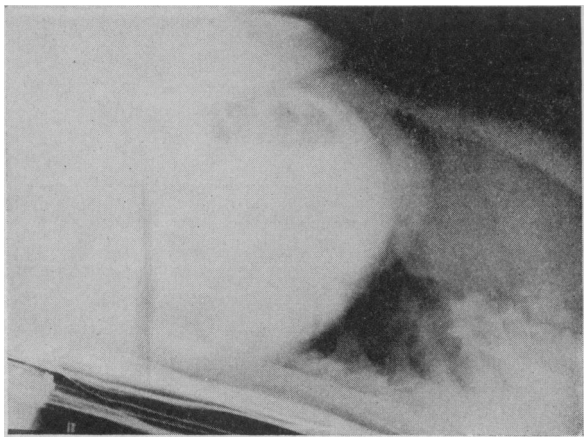

Fig. 19.—Roentgenogram, showing crowding of heart and lungs in extreme lithotomy position.

Mastoid Operations.—In preparing for the mastoid operation it is advisable to anesthetize the patient in a comfortable dorsal position with the abdominal stretch relieved by a bolster under the knees. After the patient is asleep, the head is adjusted on an oval ring sand pillow. The posterior half of the pillow is higher than the anterior half on which the face rests. A small sand pillow placed under the neck further aids in securing good exposure of the mastoid region. The head is turned well to the side, the chin to the chest, and by pulling the arms down the shoulders are less in the way. The guard [16] shown is adjustable to any height and may slip under the mattress or under the sand bags. Being a frame over which the draping sheet rests, additional light is admitted. It is out of the way and may even be used by the assistants as an arm rest. It gives adequate exposure to enable the anesthetist to watch the face (Figs. 20 and 21).

Posture in Tonsillectomy Operations.—Pictures of various positions used in tonsillectomy appear in an article by Doctor Hara [17] in the September 1930 CALIFORNIA AND WESTERN MEDICINE. He reports from his bronchoscopic studies of one hundred and ten patients to determine the comparative merits of posture on aspiration that the Rose position, with the head in a much lower plane than the body, gave the greatest protection. He states that next in order are the Trendelenburg, the extreme extension, and the moderate extension. The erect posture gave the largest amount of aspiration. The dangers of aspiration may be considerably reduced with a proper combination of these methods which aims to keep the blood and secretions in the nasopharynx where they can easily be suctioned or sponged away. Naturally, less postoperative nausea and vomiting occur since there is practically no blood in the stomach. The possibility of lung complications after nose and throat operations is minimized.

DANGERS OF CHANGES OF POSTURE

There are certain dangers in change of posture in anesthetized patients because of the impairment of normal vasomotor control. When an operative position which is not comfortable for the conscious patient is required, anesthesia should be induced in a position which is comfortable. If the patient's position is altered during induction,[5] mucus or saliva may irritate the throat and the swallowing reflex be excited. Coughing, attempts to vomit, holding of the breath may soon follow. A dangerous degree of cyanosis and other asphyxial phenomena may soon appear. These unnecessary complications may be avoided if full anesthesia is obtained before any change is effected and if the breathing is watched carefully during the change. Respiratory embarrassment is more likely to occur in plethoric individuals and in those who have short, fat necks, and may be seen in them when the posture is changed, even though the anesthesia is full.

Hewitt [5] states that a change of posture made toward the finish of the anesthesia "rarely causes respiratory embarrassment of any importance." This fact makes postural drainage possible when it is necessary, especially when the anesthesia is light, as following nose and throat operations.

A rapid fall in blood pressure in abdominal operations [18] may be caused by turning the patient on his side, especially if the anesthesia has been prolonged. This fact was noted during the World War and is recorded in the American reprint of the "Official British Manual of Injuries and Diseases of War." A patient may be in good condition at the close of an abdominal operation, but a drop of blood pressure and weak pulse soon follow if another operation is attempted with the patient on his side. This lost resistance is only slowly regained. The advice given to war surgeons is that "if possible, wounds of the back should be dealt with before laparotomy, as turning the patient has no ill effect during the first half-hour of an ether anesthesia."

When it is necessary to change the position to apply a bandage or plaster dressing following an operation, light anesthesia is advisable before the trunk is elevated.

Extreme gentleness is required in making any change of posture in patients who are in some degree of shock. Raising a patient from the dorsal to the Fowler position or from the Trendelenburg to the horizontal position may have added danger unless a sufficient degree of vasomotor control, absent during anesthesia, is recovered.

Doctor Miller [9] believes that the routine use of the reverse Trendelenburg or Fowler position, following certain types of operation, is unsafe unless the patient's condition has first been proved satisfactory by blood pressure readings.

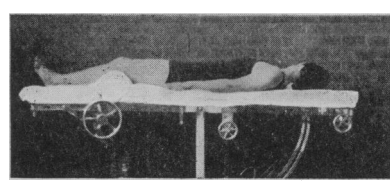

Fig. 20.—Mastoid position.

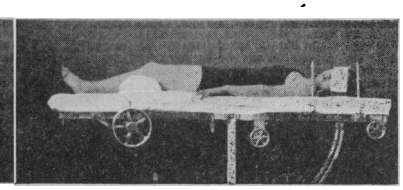

Fig. 21.—Mastoid position, showing adjustable guard.

A stretcher, hinged at the head end and provided with a worm gear to obtain any desired foot elevation, for safe transferance of patients having spinal anesthesia is described by Doctor Furniss [19] in the *Americal Journal of Surgery*. It is also valuable to provide proper drainage following nose and throat operations, in cases of shock, or used in the reverse position for pelvic drainage.

CONCLUSIONS

The patient's comfort is secured by attention to the details of improved posture before anesthesia is induced, by maintenance of a safe posture during the operation and by continuing the protection of the comfort and safety in his return to bed. The increased relaxation, the possibility of lighter anesthesia, the better postoperative condition and lessened discomfort are assets of the surgeon and anesthetist.

1955 Broadway.

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PATHOLOGIC DEPARTMENTS OF SMALL HOSPITALS*

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LABORATORY examinations started in the hospital about 1890, when the routine examination of the urine was attempted. The only other examination that was made was an occasional estimation of the hemoglobin content of the blood. The scope of this work should be contrasted with the demand made upon the laboratory by the clinician today. The hospital laboratory must comply with the demand for biochemistry, clinical bacteriology, serology, clinical chemistry, functional tests, morbid anatomy, surgical pathology, basal metabolism, and clinical microscopy. If it is to be worthy of the hospital, the laboratory must conduct teaching courses and research.

The physicians who have graduated in the last ten years lean heavily upon the laboratory for diagnoses. Older men say that the art of clinical diagnosis will soon be lost. The reaction against this teaching has been felt in all the medical schools already and the students of medicine today no longer place blind confidence in laboratory determinations but compare them with clinical evidence.

The demand for laboratory work brought into being a horde of laboratories: some good, some bad, some indifferent, and some unspeakable. At the same time there arose a class of physicians who specialized in laboratory medicine.

In 1926, about thirty-five years after laboratory work started, fourteen hundred and three laboratories were sent questionnaires by the American Medical Association. The hospital laboratories, numbering about four thousand, were omitted from the list. One thousand and eighty replied. Of these, only one hundred and sixty were able to meet the rather low standards set by the association at this time and gain admission to its approved list.

LABORATORY STANDARDS

The standards of the American Medical Association require that the director shall be a physician, graduated from an acceptable school of medicine, who has specialized in laboratory medicine for three years. The standard also includes the licensing of the physician in the state when diagnoses are made by the laboratory director. Only a minimum of equipment is necessary for approval.

The laboratory standard of the American College of Surgeons simply states the minimum requirement, which is that the laboratory be "under competent supervision." This has been interpreted as being "best done through the medium of a clinical pathologist."

California, through the efforts of Doctor Kellogg and the State Board of Health, has offered voluntary inspection and certification of labora-

* Chairman's address, Pathology and Bacteriology Section of the California Medical Association at the sixty-first annual session, Pasadena, May 2-5, 1932.